
Quality Assessment of Online Hearing-Related Information in the French Language

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“Better awareness drives better choices and better choices create better results.”

Robin Sharma

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Abstract

Purpose: An increasing number of people turn to the Internet for medical information and guidance. Nevertheless, the content quality of health materials varies widely and is generally low. The current study aims to assess the quality of online health information in the French language specific to hearing. This study extends the recent thesis completed in 2018 by former Master of Audiology student Marius Serban.

Method: Fifty-one quasi-randomly selected webpages, previously identified by Serban, were rated and assessed using a quality specific tool: the DISCERN questionnaire. Two native French speakers used the DISCERN instrument to judge the quality of French written health information about treatment choices. The webpages were then categorised and evaluated in terms of their region of origin (Europe and North America), type of organisation (i.e., non-profit, commercial and governmental) and whether they had HON code certification. Descriptive statistics were used to report the obtained quality ratings and an ANOVA was used to determine whether there would be significant differences in DISCERN ratings based on the location of website host, type of organisation and on the presence or absence of HON certification between the identified webpages. Finally, the webpages were assessed and compared in terms of their quality and readability scores using a Pearson correlation.

Results: Overall, the webpages exhibited moderate quality as determined by the DISCERN rating scores. The majority, that is 26 webpages, obtained a DISCERN score between 3.00 and 3.90. Only one webpage earned a DISCERN score of 5.00, and two webpages received a low DISCERN score of 1.50. The webpages were equally

distributed by location and type of organisation; however, the majority of the webpages (61%) did not have HON certification. Results show that no significant differences were found in DISCERN scores among webpages based on the region of website host, type of organisation, and on the presence or absence of HON certification. Additionally, there was a positive non-significant relationship between DISCERN and readability scores. Similarly, the readability level of all webpages was higher than the recommended level, indicating at least 13 years of education for the consumers to efficiently read and comprehend the hearing-related information.

Conclusion: The quality and readability of hearing-related information provided on the Internet in the French language are far from optimal. The findings have shown that the majority of the websites available to French readers with a hearing disability, and to their significant others, are well above the reading grade level recommended by health literacy experts and are lacking in quality. Such findings are concerning, as misleading and erroneous online health materials can have a significant impact on the patient's health. Recommendations have been provided to help clinicians in guiding patients towards satisfactory information and to assist website designers in developing higher quality health-related materials.

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List of abbreviations

ALD	Assistive Listening Device
ANOVA	Univariate Analysis of Variance
ASHA	American-Speech-Language-Hearing Association
ccTLD	Country Coded Top Level Domain
CI	Cochlear Implant
dB	Decibels
DHL	Disabling Hearing Loss
FRE	Flesch Reading Ease
HL	Hearing Loss
HI	Hearing Impairment
HA	Hearing Aid
HON	Health On the Net
HON code	Health On the Net Code of Conduct
ICC	Intra-class correlation coefficient
IOM	Institute of Medicine
LSD	Least Significant Difference
NHS	National Health Service
OIF	Organisation Internationale de la Francophonie
PCC	Patient-Centred Care
RGL	Readability Grade Level
SNHL	Sensorineural Hearing Loss
SAM	Suitability Assessment of Materials
SD	Standard deviation
SMOG	Simple Measure of Gobbledygook
WHO	World Health Organisation

Chapter One: Introduction

1.1 Study overview

With the constant growth and proliferation of technology use, the Internet has become a popular and major source of healthcare information (Fox, 2006; Gualtieri, 2009; Marton & Wei Choo, 2012) with the majority of Internet users located in Asia, Europe and Africa (Internet World Stats, 2018). Accessing healthcare information on the Internet has led individuals to self-diagnose before seeking professional expertise (Fox & Rainie, 2002; Gualtieri, 2009). Moreover, with online health material's availability, individuals are more inclined to be involved into their own health care and contribute towards decision-making (Broom, 2005; Fox & Jones, 2009; Laplante-Lévesque, Hickson, & Worall, 2010). However, studies have shown that online health information content varies greatly in quality (Eysenbach, Powell, Kuss, & Sa, 2002), and is customarily challenging to read and understand (Charnock, Shepperd, Rose, & Lucassen, 2005; Friedman & Hoffman-Goetz, 2006).

Numerous studies have shown that the readability of online healthcare materials is higher than the recommended 5th- to 6th-grade level for the intended audience (Laplante-Lévesque & Thorén, 2015; Walsh & Volsko, 2008). Online information specific to hearing has demonstrated a similar trend (Atcherson et al., 2014; Laplante-Lévesque & Thorén, 2015). Hearing loss (HL) is one of the most common sensory deficits and its prevalence has been increasing over the years (Stevens et al., 2011). To date, most health research related to the quality of hearing-related information focused on websites published in the English language (Charnock et al., 2005; Laplante-Lévesque & Thorén, 2015). Little attention has been given to the readability and quality of hearing-related health information in other languages, such as French.

As argued by Atcherson et al. (2014), patients with limited medical knowledge may lack the ability and necessary skills to evaluate whether the identified online health information is reliable and accurate. Conversely, an effective use of online health material can lead to an improvement in the patient's own wellbeing (Fox & Rainie, 2002). With this view in mind, the prevalence and impact of hearing loss can be better managed through greater quality and proper understanding of online information specific to hearing. Thus, it is crucial for readers to be able to judge the quality and adequacy of the health materials available on the Internet in order for them to get more engaged in their own health, and in turn make appropriate informed treatment choices.

The present study aims to assess the quality of online hearing-related information available to French readers. To do so, the following literature review will provide an overview of hearing loss and its impact, before assessing the factors influencing rehabilitative treatment choices. In continuation, the significance of quality and readability of online health information in shared decision-making will be reviewed. Finally, the aims and rationale of the study will be discussed.

1.2 Hearing loss

1.2.1 Prevalence of hearing loss

HL is a common condition that can be partial or total, and affects one's ability to hear (Baldwin, 2003). HL can occur in one ear or both ears, be graded as mild, moderate, severe or profound and varies widely from an individual to another (Baldwin, 2003; WHO 2018). HL can be due to multiple causes, such as genetics, chronic ear infections, complications during pregnancy, infectious diseases, ototoxic drug use, excessive noise exposure and ageing (WHO, 2018). A reduced ability in hearing can occur across all age ranges; nevertheless, it is commonly seen among the older

population (Choi et al., 2016). In fact, according to Halonen et al. (2016, p.63), age-related HL is among “the top three major chronic medical conditions in elderly people, along with cardiovascular disease and arthritis”. The prevalence rates of HL have been increasing as life expectancies rise (Dalton et al., 2003; Stevens et al., 2013). The World Health Organisation (WHO) defines a disabling hearing loss (DHL) for adults as a HL greater than 40 decibels (dB) in the healthier ear, and for children, a loss greater than 30dB in the healthier ear (WHO, 2018). According to WHO, around 466 million people around the world experience some sort of DHL (WHO, 2018), 432 million of which are adults (with nearly one third over 65 years of age) and 34 million are children (under 15 years of age). As argued by WHO (2018), these numbers will increase over the coming years with an estimation of 900 million people with DHL by 2050. However, DHL’s distribution appears unequal worldwide (WHO, 2018). A greater prevalence of people with HL live in low- and middle-income countries (Stevens et al., 2013), with the majority of people in South Asia, Asia Pacific and sub-Saharan Africa (WHO, 2018).

There are limited data on the prevalence of HL in French-speaking countries. French is ranked fifth in the world’s most spoken languages, with 300 million speakers around the world, due to a recent growth of French speakers in Africa (L’Organisation International de la Francophonie, OIF, 2018), and is also ranked the second most used language in Europe with 77 million speakers (Ministry for Europe and Foreign Affairs, 2018). The majority of French speaker are located in Europe (45.7%), sub-Saharan Africa and the Indian Ocean (34.8%), and other regions such as North Africa and the Middle East (12.9%), North America (4.4%), Latin America/Caribbean (1.6%) and Oceania/Asia (0.6%) (OIF, 2018). In terms of HL, it has been estimated that about 7 million people in France have a hearing disability, that is around 9.3% of the population (Kervasdoué & Hartmann, 2016), and 40% of adults in Canada between 20 to 79 years

old demonstrate at least a slight HL (Statistics Canada, 2016), with a higher prevalence of HL among older age groups. Moreover, as discussed earlier, there is a greater prevalence of adults and children with hearing impairment (HI) located in low and middle socio-economic countries (Stevens et al., 2013), including Francophone countries such as North Africa, sub-Saharan Africa and the Asia Pacific region (OIF, 2018).

1.2.2 Impact of hearing loss

The result from a puretone audiometry test, which is commonly used to assess HI, is not sufficient to predict the full impact of an acquired or congenital HL on an individual (Hallberg, Hallberg, & Kramer, 2008). However, studies have demonstrated that even a partial inability to hear can have significant consequences on an individual's health (Johnson, Danhauert, Ellis, & Jilla, 2016; Newman, Hug, Jacobson, & Sandridge, 1997). First, an unaddressed HL leads to a decrease in speech perception and intelligibility, which in turn reduces one's ability to effectively communicate with others (American Speech-Language-Hearing Association, ASHA, 2016; Campbell, Crews, Moriarty, Zack, & Blackman, 1999; Johnson et al., 2016; Keller, Morton, Thomas, & Potter, 1999; Kramer, Kapteyn, Kuik, & Deeg, 2002). Moreover, frequent exclusion from communication can often lead to social isolation, a decline in physical activities and in overall wellbeing; these ultimately create significant adverse effects on an individual's quality of life, especially amongst the older population (Chisolm et al., 2007; Dalton et al., 2003; Kramer et al., 2002; Newman et al., 1997; WHO, 2018).

For adults, a reduced ability to hear and follow conversations, especially in noisy environments, such as restaurant settings and large work meetings, can lead to feelings of loneliness, fatigue and frustration (Crandell, 2006; Hornsby, 2013), resulting

eventually in a decrease in performance at work, isolation and mental health issues including depression (Arlinger, 2003; Campbell et al., 1999; Chia et al., 2007; Dalton et al., 2003; Strawbridge, Wallhagen, Shema, & Kaplan, 2000). An untreated HL impacts not only the individual with a hearing disability but also their significant others, such as family, partner and friends (Arlinger, 2003; Scarinci, Hickson, & Worrall, 2012). The diminished ability to hear and communicate effectively makes the interactions between the individual with a HL and the other people in their environment more challenging and tends to lead to frequent repetitions, misunderstandings and frustration (Scarinci, Worrall & Hickson, 2008; Scarinci et al., 2012). Early identification and treatment of HL, however, can decrease the negative socio-emotional impacts of HL, and with appropriate counselling and support can improve the quality of life of both the patient and their significant others (Chisolm et al., 2007).

For children, an unaddressed HL has the most impact on their speech and language development (Rescorla, 2002). As argued by Nicholas and Geers (2006), the first few years of life are crucial to acquire language information, and then form a cognitive and linguistic foundation that is necessary for the child's self-development (Nicholas & Geers, 2006). Children deprived of sufficient speech sound input are more likely to experience speech and language delays (Nicholas & Geers, 2006). Furthermore, compared with children with normal hearing, children with HL are reported to face greater challenges at school, show poorer academic performance, and have social and behavioural problems (Yoshinaga-Itano, 2003; Prizant & Meyer, 1993); however, early diagnosis and treatment of HL can significantly improve children's developmental outcomes (Nelson, Bradham, & Houston, 2011; Nicholas & Geers, 2006; Yoshinaga-Itano & Gravel, 2001).

1.2.3 Effects of hearing loss treatment

The negative impacts of untreated HL described above can be reduced or even avoided via specific management approaches and treatment choices that are suited to the individual (Dalton et al., 2003; Laplante-Lévesque et al., 2010). There are numerous treatment options available based on the type and degree of HL of the patient. Certain types of HL require medical and/or surgical procedures; however, the use of amplification via hearing devices remains the most common procedure towards auditory rehabilitation (Baldwin, 2003). Hearing devices aim to increase the audibility of sound in order to facilitate speech perception; such devices include hearing aids (HAs), assistive listening devices (ALDs) and implantable devices (Baldwin, 2003; Dalton et al., 2003; Zaidman-Zait & Most, 2005).

According to WHO (2018), hearing loss in 60% of childhood cases can be prevented (the prevalence being higher in low- and middle-income countries). Thus, early diagnosis and management of HL is crucial in reducing the negative impact on children's speech and language development (WHO, 2018). A study conducted by Nicholas and Geers (2006) found that cochlear implantation in profoundly deaf children dramatically affected their spoken language competence. Children achieved significant language improvements by using most of the auditory input available in their surroundings, when cochlear implants (CIs) were surgically implanted early (Nicholas & Geers, 2006). It was concluded that children implanted in infancy exhibited better language progress than deaf children implanted in early childhood (Nicholas & Geers, 2006). In addition, other studies have shown that early identification and intervention in children with HL lead to greater social and emotional development, better speech intelligibility and communication abilities (Blarney, Barry, & Jacq, 2001; Robinshaw,

1995; Tobey, Geers, Brenner, Altuna, & Gabbert, 2003; Walker et al., 2015) and show age-appropriate language and cognitive skills (Meinzen-Derr, Wiley, & Choo, 2011).

In the older population, studies have demonstrated that early interventions showed improvements in the mental and physical wellbeing of adults with HL (Contrera et al., 2016). Outcomes and benefits of treatment on quality of life with HA use are generally evaluated via the use of self-report questionnaires (Cox & Alexander, 2002). A systematic review of 16 studies conducted by Chisolm and colleagues (2007) focusing on the benefits of HA use by adults with acquired sensorineural hearing loss (SNHL) showed improvement in their psychological and socio-emotional wellbeing.

Additionally, it was observed that adults HA users showed improved speech perception, reduced frustration in daily activities, enhanced social interaction, and improved cognitive skills (Appollonio, Carabellese, Frattola, & Trabucchi, 1996; Choi, Shim, Lee, Yoon & Joo, 2011; Contrera et al., 2016; Kochkin & Rogin, 2000; Polku et al., 2018), compared with hearing impaired individuals who did not to use HAs. Finally, a study conducted by Johnson et al. (2016) concluded that even adults with mild SNHL could benefit from HA use. Though the benefits of early identification and intervention towards HA use are apparent, various personal and external factors exist that play a role in hearing-related health outcomes (Dalton et al., 2003; Laplante-Lévesque et al., 2010; Sprinzel & Riechelmann, 2010).

1.2.4 Factors influencing treatment choices

Despite clear positive evidence associated with early hearing intervention, numerous patients do not receive treatments. According to Davis et al. (1993), a significant number of people live with their HI for more than ten years before seeking support and help; time during which the degree of HL can worsen (Davis et al., 1993).

Studies have identified numerous factors influencing decision-making in aural rehabilitation. There are personal factors, which include patient's motivation, expectation, self-perceived hearing handicap, attitude towards HAs (Knudsen, Oberg, Nielsen, Naylor, & Kramer, 2010; Laplante-Lévesque et al., 2010), and external factors such as adequate counselling and follow-up (Elwyn et al., 2012; Knudsen et al., 2010; Solheim, Kvaerner, Sandvik, & Falkenberg, 2012), support from their significant others (Hickson, Meyer, Lovelock, Lampert, & Khan, 2014), and financial concerns about the cost of HAs (Laplante-Lévesque et al., 2010). Other factors that influence whether the patients are more likely to adopt the HAs focus on the patient's personal needs and wellbeing, also referred to as patient-centred care approach or PCC (Dillon, James, & Ginis, 1997; Jennings, 2009), a trust-based patient-clinician relationship (Kelley et al., 2015), and active participation in decision-making (Charles, Gafni, & Whelan, 1997; Laplante-Lévesque et al., 2010).

“No decision about me without me” is the motto stated by the British National Health Service (NHS) to emphasise the importance of patients' involvement in decision-making (Department of Health, 2012, p.7). Shared decision-making is defined as a collaborative patient-clinician relationship, with both involved in information exchange and decision-taking (Charles et al., 1997). Although the amount of involvement in clinical treatment choices might change from one individual to another, taking an active role in decision-making is strongly associated with positive health-related outcomes (Kaplan, Greenfield, & Ware Jr, 1989; Laplante-Lévesque et al., 2010; Stevenson, Cox, Britten, & Dunder, 2004).

This approach is particularly relevant to the field of audiology, as adherence to HAs requires a significant amount of time, persistence and self-management (Arlinger, 2003). According to Laplante-Lévesque and colleagues (2010), adults actively involved

in shared decision-making appear to pay more attention and take greater responsibility for their own health care; which in turn lead to increased satisfaction and improved health outcomes (Grenness, Hickson, Laplante-Lévesque, Mayer, & Davidson, 2015). However, to enable clients to make informed treatment choices, while being fully aware of the benefits and consequences of each intervention, the provision of health-related information must be accurate and complete (Adams & Drake, 2006; Shepperd et al., 1999). Information from healthcare providers is perceived by the consumers as reliable and honest, and remains one of the most prevalent sources of healthcare information (Couper et al., 2010). However, with its increasing growth, the Internet has become a popular source for health-related information (Dutta-Bergman, 2004).

1.3 The role of online health-related material

1.3.1 Health information in the digital age

Over half of the population around the world is now using the Internet, as reported by We Are Social in their annual report published in June 2018. According to Internet World Statistics (2018), there are now over 4 billion Internet users on the planet. A few decades ago, health information was provided through different type of sources such as published work and media sources (e.g., newspapers, television, radio; Brossard, 2013; Dutta-Bergman, 2004) and professional workers (e.g., healthcare providers, teachers; Hoffmann & McKenna, 2006). In recent years, the Internet has gained in popularity and has become one of the most used sources of information, including health-related information (Fox, 2006). Access to the Internet is spreading worldwide and the number of users is increasing by more than 200 million new users yearly (We Are Social, 2018). Internet World Statistics (2018) define penetration rate as

the percentage of people in a given region that uses the Internet. Data reported below in Figure 1 and Table 1 show the statistics distribution of Internet usage around the world:

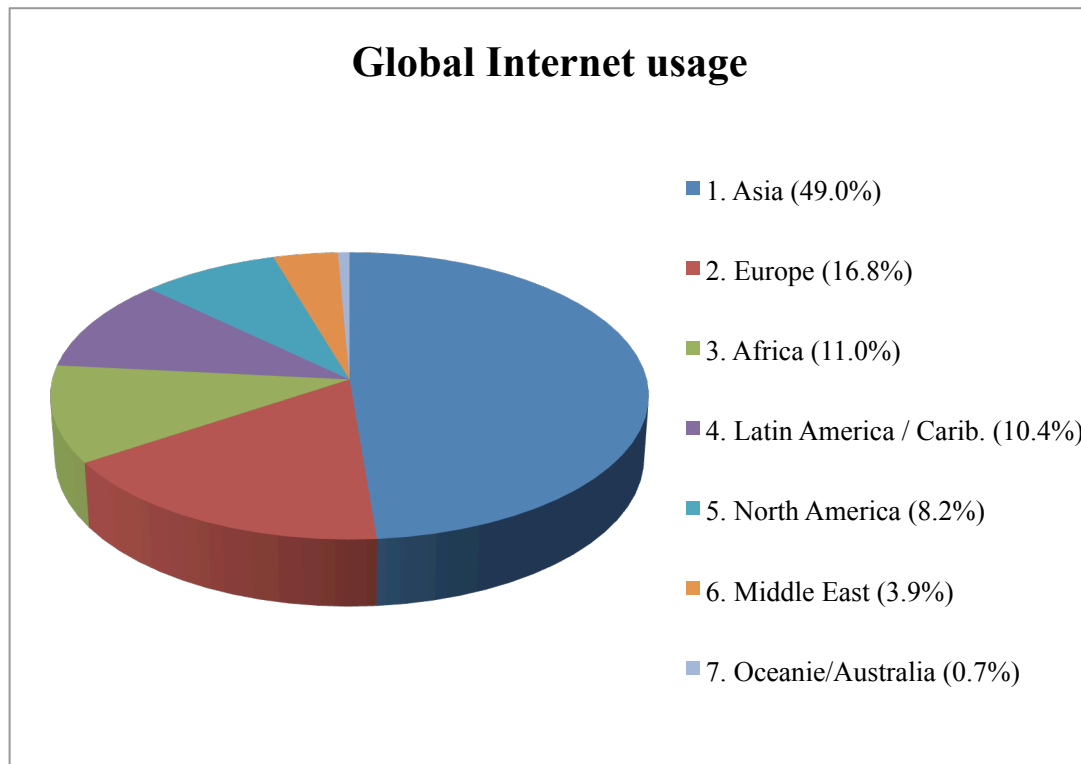


Figure 1. Distribution of Internet users worldwide

Information can be accessed at this URL: <https://www.internetworldstats.com/stats.htm>

Table 1. World Internet Usage Statistics

World Regions	World population	Penetration Rate
Asia	55.1%	49.0%
Europe	10.8%	85.2%
Africa	16.9%	36.1%
Latin Am/Caribbean	8.5%	67.2%
Middle East	3.3%	64.5%
North America	4.8%	95.0%
Oceania/Australia	0.6%	68.9%
WORLD TOTAL	100%	55.1%

Retrieved from: <https://www.internetworldstats.com/stats.htm>

It can be seen that the majority of Internet users are located in Asia (49%) and Europe (16.8%) (Internet World Stats, 2018). The two highest worldwide Internet penetration rate are 95% in North America and Europe with 85.2%, and the lowest penetration rate is Africa with 36.1% (Internet World Stats, 2018). However, according to We are Social (2018), the number of Internet users across Africa has increased significantly by more than 20% in one year. At the present moment, Africa exhibits the fastest growth rates of Internet users globally. In terms of languages, as reported by Internet World Stats (2018a), French is one of the top ten languages most widely used on the Internet, and accounts for 5% of the world's online material (Ministry for Europe and Foreign Affairs, 2018).

Numerous studies have shown an increase of Internet searches towards health-related information (Baker, Wagner, Singer, & Bundorf, 2003; Fox, 2006; Fox, 2011; Laplante-Lévesque et al., 2010). In the United States, online health information searches represented the third most common Internet activity (Fox, 2011) and in Europe over 70% of Internet users reported searching for healthcare materials online (Andreassen et al., 2007). Over the years, the Internet has evolved to be one of the most commonly used mediums of health-related information, for various reasons. It is a cost-effective method that facilitates access to a significant amount of health material and provides independent learning and anonymity (Cline & Haynes, 2001; Dutta-Bergman, 2004; Fox, 2006; Fox & Jones, 2009). Moreover, individuals perform an online search, to look for advice and additional opinions related to their health condition, as a medium of support towards medical decision-making (Bessel, Silagy, Anderson, Hiller, & Sansom, 2002; Laplante-Lévesque, Pichora-Fuller, & Gagné, 2006). Among those using the Internet to search for health-related material are individuals affected by a hearing disability and their significant others (Peddie & Kelly-Campbell, 2017).

A study performed by Laplante-Lévesque et al. (2010) found that adults with a HL in Australia search for information on the Internet before making any decisions regarding their hearing conditions. According to Barak and Sadovsky (2008), individuals with HI use the Internet more than individuals with normal hearing because their hearing disability prevents them from successfully communicating with their healthcare providers. Nevertheless, this independence towards online health information seeking can have a negative effect on the readers. As argued by Fox and Jones (2009), online material can influence the health decisions of Internet consumers and lead the individuals to diagnose themselves based on the information found online, sometimes without confirming its accuracy with health professionals (Fox & Rainie, 2002). Various

studies have reported that much of the health information found on the Internet varies greatly in quality, and is difficult to read and understand (Charnock et al., 2005; Friedman & Hoffman-Goetz, 2006). There is a lack of regulation and quality control of the health content available on the Internet, and consequently healthcare information may be misleading, unreliable and could lead to potential harm (Beaunoyer, Arsenault, Lomanowska, & Guitton, 2017; Griffin, McKenna, & Tooth, 2003).

1.3.2 Health literacy

Health literacy plays a fundamental role in the maintenance of the health care and wellbeing of an individual (Hibbard, Peters, Dixon, & Tusler, 2007). As referred to the Institute of Medicine (IOM) report, health literacy is defined as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (Ratzan & Parker, as cited in Nielsen-Bohlman, 2004, p.32). In essence, health literacy is one’s ability to effectively evaluate and comprehend health materials with regard to making informed treatment decisions (Health Navigator, 2018).

Health literacy has been much studied in the United States and according to Nielsen-Bohlman (2004), nearly half of American adults have inadequate health literacy skills. Additionally, it was observed that a third of the British elderly population seeking medical help showed basic health literacy along with difficulty reading and understanding basic health-related materials (Bostock & Steptoe, 2012). Limited health literacy is perceived as one of the greatest risk factor of negative health outcomes, and is often linked to individuals with little educational background, minority ethnicity, low socioeconomic status and the elderly population (Nutbeam, 2008; Parker, 2000). These findings are aligned with WHO (2018) mentioned previously. Moreover, DeWalt,

Berkman, Sheridan, Lohr, and Pignone (2004) found that patients with basic health literacy skills are less likely to use health services and are more at risk of adverse health outcomes than patients with higher health literacy.

Low health literacy has been consistently associated with poor health knowledge, an increased use of the healthcare system, limited ability in illness management and lower health outcomes (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; DeWalt et al., 2004; Nutbeam, 2009; Weiss, Hart, & Pust, 1991). For instance, limited health literacy can impede one's ability to accurately interpret medication prescriptions, fill in medical forms and appropriately understand health professionals' instructions (Berkman et al., 2011; Kutner, Greenberg, Jin, & Paulsen, 2006).

A study performed by Aboumatar, Carson, Beach, Roter, and Cooper (2013) investigated patients with hypertension and the impact of health literacy on patient-doctor interaction during a medical visit. They found that patients with low literacy skills were as interested in medical decision-making as were clients with adequate literacy skills; however, low literacy patients appeared to ask fewer questions. Similarly, a mixed methods study performed by Katz, Jacobson, Veledar, and Kripalani (2007) reported that low-literate patients are less likely to ask questions during medical encounters and seek additional health supports. The inability to communicate effectively with the clinicians during medical visits and to fully understand complex health information can influence patients' treatment choices and subsequently impact their health conditions (Berkman et al., 2011; Hibbard et al., 2007).

To address this issue and provide quality healthcare, a patient-centred care approach must be at the core of medical interactions. In order for individuals to make informed health choices and take actions that will best meet their needs, clinicians must ensure effective communication with the patients, and written medical information must

be presented in a format that is understandable and clear (Fergusson & Pawlak, 2011; Hibbard & Peters, 2003; Shepperd et al., 1999). Health literacy is strongly associated with education and the ability to read. DeWalt et al. (2004) found that people with a lower ability to read are about three times more prone to poorer health outcomes than people with a higher reading level. Thus, to empower patients to make informed decisions about their health conditions, the health materials provided should match the literacy skills of the patients (Hibbard & Peters, 2003). Readability assessment tools can help in the evaluation of health information (Atcherson et al., 2014).

1.3.3 Readability of health information

Dubay defined readability as “what makes some texts easier to read than others” (2004, p.3). Readability assessments help predict the reading ease of a written text and are reported as a Reading Grade Level (RGL) (Laplante-Lévesque, Brännström, Andersson, & Lunner, 2012). Each RGL corresponds to different educational grade levels (Bailin & Grafstein, 2001; Doak, Doak, & Root, 1996). For instance, a text rated at an RGL of 6 is suitable for individuals with at least six years of formal education (Doak et al., 1996). The higher the RGL, the more challenging it is for an individual to fully comprehend given material and the more likely misunderstandings are to occur (DuBay, 2004). In regard to the negative effects of limited health literacy discussed earlier, it is crucial that written health materials are presented at a satisfactory level of readability in order for consumers to avoid misinterpreting the complex medical information available to them, and to take appropriate health decisions (Britten, Stevenson, Barry, Barber, & Bradley, 2000; Hibbard & Peters, 2003).

According to Doak and colleagues (1996), individuals who can read at an RGL of 5 or higher are considered to be literate. Thus, to facilitate health literacy and ensure

that the medical information provided will be intelligible to the majority of the adult population, health materials must be written and presented at the recommended RGL of 5 or 6 (Atcherson et al., 2014; Doak et al., 1996). However, numerous studies have reported that the majority of health materials are graded well above the recommended 5th- to 6th-RGL, and were considered not suitable for the average reader (Barak & Sadovsky, 2008; Laplante-Lévesque & Thorén, 2015; Walsh & Volsko, 2008).

In regard to the readability of hearing-related information, a similar trend was observed (Atcherson et al., 2011; Atcherson et al., 2014; Laplante-Lévesque et al., 2012). A systematic review performed by Laplante-Lévesque and Thorén (2015), reported that the majority of audiological websites identified on the Internet were rated at an RGL of 9 and above, indicating that the information on hearing was complex and difficult to comprehend for the average reader. Such findings are concerning, as readers with limited medical knowledge may lack the ability to judge whether the material provided is accurate and reliable (Atcherson et al., 2014).

In order to perform a readability analysis and assess how difficult a text is to read, specific readability equation formulas are used (DuBay, 2004). Readability formulas assess the linguistic characteristics of a written text, such as vocabulary and grammar complexity, length of a word (measured in number of syllables) and/or sentence length (DuBay, 2004). Readability formula equations are designed to assess the difficulty of a text objectively and quantifiably (Bailin & Grafstein, 2001); however, these formulas have not been designed for assessing medical terms (Shedlosky-Shoemaker, Sturm, Saleem, & Kelly, 2008), thus extra care must be taken when producing health materials. The first readability formula, the Flesch Reading Ease formula was published in 1942 and was designed to assess the readability of written text for adults in the English language (DuBay, 2004). Other popular formulas

commonly used in the English language are The Flesch-Kincaid (Kincaid, Fishburne Jr, Rogers, & Chissom, 1975) and the Simple Measure of Gobbledygook or SMOG (Mc Laughlin, 1969). There are numerous formulas that have been designed for the English language, and yet, few readability formulas exist that apply to languages other than English.

Few studies have assessed the readability of French written text, starting with Conquet who first studied the readability of the French language in 1957. A year later Kandel and Moles (1958) were the first to introduce a modified version of the Flesch readability formula using specific linguistic features adapted to the French language. Subsequently, the Flesch-Kincaid formula adapted to the French language has been widely used to analyse the readability of French written text (Tekfi, 1985). A previous study conducted by Marius Serban (2018) also used an adaptation of the Flesch-Kincaid formula referred to as French version of the Flesch Reading Ease (FRE) formula in order to assess the readability of hearing-related webpages written in the French language. An FRE score of 70 or higher, corresponding to an RGL of 6 or lower, has been the reading grade level recommended by experts in the field of health literacy (Weiss, 2003). Further information about the FRE readability formula will be discussed in Chapter 2.

1.3.4 Quality of health information

The quality of healthcare information available on the Internet is of critical concern. Past studies have shown that the content of online health information is of variable quality and can be misleading due to a lack of regulation (Beaunoyer et al., 2017; Charnock et al., 2005; Eysenbach et al., 2002; Griffin et al., 2003). A systematic review conducted by Eysenbach and colleagues (2002), assessing the quality of online healthcare information, reported that the quality of information available in over 70% of

the identified studies was inaccurate, and lacked quality and completeness. Additionally, online materials related to hearing show a similar pattern (Laplane-Lévesque et al., 2012; Seymour, Lakhani, Hartley, Cochrane, & Jephson, 2015), as did healthcare information provided on French-speaking websites (Givron et al., 2004; Richard et al., 2007). Richard and colleagues (2007) evaluated the quality of online health information about the diabetic foot in the French language, and concluded that the information delivered by most French-speaking websites were of poor quality and highly variable. The variable quality of online health materials is of significant importance as studies showed that over half of consumers trust the accuracy of online information regardless of its source (Fox, 2006) and subsequently, it can potentially influence the readers' conduct in their decision-making (Couper et al., 2010; Fox & Jones, 2009). Laplane-Lévesque and colleagues (2012) discussed methods to help measure and address the diverse quality of health-related information available on the Internet.

Tools exist to help consumers, medical professionals and/or researchers to evaluate the quality of online health materials. DISCERN is a tool developed in the late 1990s, which has been designed to rate the quality of health information and help the readers judge the overall quality of written materials in order to make appropriate informed treatment choices (Charnock et al., 1999). The DISCERN tool will be used in the current study: DISCERN is a questionnaire of 16 items, separated into two sections. Each of the 16 questions are to be rated from 1 to 5 and represents a separate quality criterion assessing the relevance of information, reliability, treatment benefits and risks mentioned and overall quality rating, among others (Charnock et al., 1999). For example, a rating of 5 for question 16 corresponds to a high quality publication and a great source of information to make a treatment choice. Conversely, a low rating of 1 for question 16 corresponds to a poor quality publication, with significant limitations, which

should not be used as source of information (Charnock et al., 1999). DISCERN is known for its high reliability (Rees, Ford, & Sheard, 2002) and has been described as having good interval validity and inter-rater agreement (Laplante-Lévesque et al., 2012). It has been used in numerous studies in various health fields, including audiology (Laplante-Lévesque et al., 2012).

Another method to evaluate and ensure the quality of websites is via a set of ethical guidelines designed to demonstrate to consumers that the online information presented is reliable, objective and trustworthy (Shedolsky-Shoemaker, Sturm, Saleem, & Kelly, 2008). For instance, there is the Health On the Net (HON) foundation, which is a non-profit organisation founded in 1995. HON provides a code of conduct known as the HON code, its aim being to standardise the reliability of health information on the Internet (Team HON, 2018). Display of the HON code logo on websites can reassure consumers and health professionals that the founders of the websites have followed the required guidelines and intend the published information to be reliable and of high quality (Team HON, 2018).

1.4 Rationale and aims of the study

This chapter has reviewed the prevalence, impact of hearing loss and the factors influencing treatment choices. Additionally, the role of online health-related materials and the importance of health literacy have been discussed. Health literacy has been described as one of the most significant factors in predicting health outcomes (Weiss, 2003). Previous research found that a large number of individuals in developed countries show poor health knowledge and inadequate health literacy skills; however, this number greatly rises in countries that are less developed socio-economically. As individuals are increasingly turning to online sources to look for medical information, it is important to

examine the quality of information content on websites to attempt to promote a higher standard of quality healthcare information and reduce health inequalities. As part of a larger project, this study aims to evaluate and compare the quality and readability of online health information that is specific to hearing in the ten most widely spoken languages worldwide. Moreover, this study follows up on the thesis completed by former Master of Audiology student Marius Serban.

From 2017 to 2018, Serban assessed the readability of online hearing-related information in the French language. The readability of the webpages was evaluated using the French version of the Flesch Reading Ease (FRE) formula. Websites were categorised into regions based on the location of their hosting organisation: Europe, North America, and others (including Africa, Asia, and the Pacific) and type of organisation (non-profit, commercial and governmental). The majority of websites were hosted in Europe (76.9%) and North America (16.2%). The results of Serban's study showed that hearing-related websites in the French language were difficult to read and exceeded the maximum RGL recommended by health literacy experts. Serban's study results provided useful information about readability; however, they are only the first step in assessing online hearing-related information in French and further research is needed.

To date, few studies have analysed the quality content of online health information in the French language. Moreover, there are no published studies in which the DISCERN tool has been used to evaluate health information specific to hearing in French. Consequently, the aim of the current study is to use the DISCERN questionnaire to assess the quality of a sample of the webpages identified by Serban (2018) and evaluate how it compares to the quality of other health websites written in English and French. In addition, this study wish to determine whether a significant difference exists

in DISCERN ratings based on the region of website host (Europe and North America), the type of organisation (non-profit, commercial and government) and whether the websites had HON code certification. Moreover, the DISCERN ratings and mean FRE scores of the identified webpages will be compared and evaluated in order to discuss the extent to which online hearing-related information in French helps French readers make informed decisions about their hearing needs. Finally, the following null hypotheses will be tested:

Ho1. There is no significant difference in DISCERN ratings of websites based on location of website host (Europe and North America).

Ho2. There is no significant difference in DISCERN ratings of websites based on type of website host (non-profit, commercial and governmental).

Ho3. There is no significant difference in DISCERN ratings of websites based on the presence or absence of HON code certification.

Ho4. There is no significant relationship between the DISCERN ratings and the mean FRE scores for the websites.

Chapter Two: Methods

This study aimed to examine the quality of quasi-randomly selected online websites of hearing-related information in the French language. This study was conducted at the University of Canterbury located in Christchurch, New Zealand. The webpages were previously identified by, former Master of Audiology student, Marius Serban. The current study evaluated a sample of 51 webpages with a deeper focus on treatment choices, and compared the quality ratings and the readability scores of the identified webpages. Readability was previously analysed by Serban using the Flesch Reading Ease (FRE). In this study, the quality of the webpages was assessed independently by two native French speakers, using the DISCERN questionnaire.

2.1 Part One (Readability)

2.1.1 Brief review of Serban's readability study analysis

In 2017-2018, Serban assessed the readability of online hearing-related information in French. That study can be accessed at this URL: <https://nzresearch.org.nz/records?utf8=%E2%9C%93&text=marius+serban>. Nineteen Google country-coded top-level domains (ccTLDs) were used to search for online hearing-related information, and a total of 432 unique webpages were analysed. The readability of the webpages was assessed using the French version of the (1948) Flesch Reading Ease (FRE) score. The website hosting organisations originated from 16 countries. Websites were categorised into regions based on the location of their hosting organisation: Europe, North America, and others (including Africa, Asia, and the Pacific) and type of organisation (non-profit, commercial and governmental). The majority of websites were hosted in Europe (76.9%), with nearly half the websites

(45.4%) originating from France, (16.2%). North American organisations hosted 16.2% of the websites, and 6.9% of the websites were hosted by organisations in other regions. The region with the fewest websites was Africa.

2.1.2 Serban's readability results

The majority of the websites (62.5%) in French originated from commercial organisations, while (32.9%) originated from non-profit organisations and 4.6% websites originated from governmental organisations. An ANOVA revealed that there was no significant difference in websites' readability based on type of host found:

$F(2,429) = .511, p = .60, \eta^2 = .002$, and no significant difference was found based on location of hosting organisation: $F(2,429) = .99, p = .37, \eta^2 = .005$.

The majority of websites (86%) did not have HON code certification; therefore, no comparisons based on HON certification could be performed. A one-sample t-test revealed the mean FRE of all websites to be significantly greater than the recommended level of 70: $t(431) = 46.47, p < .001$. The results of Serban's study were in line with previous research in the English language and well exceeded the 6th RGL recommended by experts in the field of health literacy, meaning that hearing-related websites in the French language are difficult to read and understand for the average person.

2.1.3 Interpretation of readability scores

The Readability scores obtained were then interpreted by Serban using the Table 2 below, retrieved from:

http://www.recherchecliniquepariscentre.fr/?page_id=8088&lang=en. The Flesch index tool developed for French texts, was adapted from the English Flesch Index, and was provided online by the Recherche Clinique Paris Centre. Its purpose is to help examine the difficulty of an identified text, in order to modify the text to a more appropriate

reading level if needed. Written consent was obtained from the tool's designers in order to incorporate its use in the current study.

Table 2. Interpretation of readability score in the French Language

Flesch scores	Grade level	Stylistic level
0 to 30	University	Very difficult
30 to 50	College	Difficult
50 to 60	High school	Fairly difficult
60 to 70	7-8th	Standard
70 to 80	6th	Fairly easy
80 to 90	5th	Easy
90 to 100	4th	Very easy

2.2 Part Two (DISCERN)

As mentioned previously, the study is a continuation of Serban's 2018 study; however, the purpose of the current study is primarily to assess the quality of a sample of webpages previously identified by Serban.

2.2.1 Procedure

A total of 51 webpages originating from seven different countries were quasi-randomly selected and categorised in terms of their region of origin (Europe and North America), type of organisation (non-profit, commercial and governmental) and whether they had HON code certification. Webpages that were deemed not relevant to the purpose of the study, such as webpages dealing with insurance of hearing aids or webpages giving only the definition of hearing loss, were replaced by another randomly selected webpage from the previous study.

To assess the quality of the 51 quasi-randomly selected webpages, two native French readers conducted the DISCERN evaluation. One of the native French speakers was an audiology student, while the second native French speaker was not. First, they each reviewed the adapted DISCERN questionnaire (refer to Appendix), read the DISCERN handbook (Charnock et al., 1999) and the DISCERN website which can be accessed at this URL:

<http://www.discern.org.uk/>. Then each reader collaboratively assessed two webpages that were not part of the study, and evaluated two additional non-study webpages while discussing any inconsistencies in scores. Once both readers achieved good inter-rater reliability and felt comfortable enough to rate the webpages independently, the study materials were evaluated. Reader number one evaluated all of the 51 study webpages to obtain a DISCERN rating score from each of webpages and reader number two evaluated 15 of the randomly selected webpages to establish inter-rater reliability.

2.2.2 Statistical analysis

Descriptive statistics were computed to describe the quality ratings of online hearing-related information in the French language. A univariate (one-way)

Analysis of Variance (ANOVA) was used to determine whether there were significant differences in DISCERN ratings of websites based on the region of website host (Europe and North America), the type of website host (non-profit, commercial and governmental), and on the presence or absence of the HON code certification. Finally, the DISCERN ratings and the mean FRE scores of the identified websites were compared by using a Pearson correlation.

Intra-class correlation coefficient (ICC) and Cronbach's Alpha in SPSS were used to assess the inter-rater reliability of the DISCERN scores for the study webpages. The ICC produces a kappa value ranging from 0 to +1 (Fleiss, 1981) to give an indication of inter-rater reliability. According to Fleiss (1981), kappa values between .40 and .75 indicate fair agreement beyond than chance. Values greater than 0.75 represent "excellent agreement beyond chance" (Fleiss, 1981, p. 218) between the raters. The ICC assesses reliability by using an ANOVA. A two-way mixed model was selected for this analysis. The single measures result was used as the reliability analysis was for the mean DISCERN scores for each webpage, rather than for each DISCERN item. The kappa value from the Interclass correlation for the DISCERN scores was .847, $p < .001$, demonstrating excellent agreement between the two raters.

Moreover, within the ICC analysis, SPSS also produces a Cronbach's Alpha, which is often used to examine internal consistency. Though, it can also be used to assess the extent to which DISCERN scores measure a specific construct. The alpha ranges from a scale of 0 to + 1. Values closer to +1 represent greater internal consistency. The Cronbach's Alpha for the DISCERN scores was .917, $p < .001$, indicating a high degree of internal consistency. In addition, the ratings were not

significantly different: $F(14,14) = 12.07$, $p < .001$, meaning that the ratings can be confidently used in the subsequent analyses.

After establishing reliability, the DISCERN scores for each webpages from rater number one was used for succeeding analyses in order to test for between group differences of the quality levels of websites. This was obtained using a one-way univariate ANOVA in IBM SPSS Statistics, version 25.

Chapter Three: Data Analysis

3.1 Overview

A total of 51 webpages previously identified by Serban (2018) were included and assessed for this study. This study aimed to investigate the quality of the identified webpages based on the obtained DISCERN rating scores, in terms of their location of website host (Europe and North America), type of organisation (non-profit, commercial and governmental) and whether they had HON code certification. Most of the webpages originated from Europe (75%) and 25% from North America. Finally, the webpages were assessed and compared in terms of their quality and readability scores.

3.2 Distribution

First, to evaluate the distribution of websites host countries originating from Europe and North America, a Pearson Chi Square test was performed. The webpages were unequally distributed by region, with most webpages originating from Europe: $\chi^2(1, 51) = 12.26, p < .001$. That is, 75% of the websites originated from Europe (with 76% of those from France) and 25% from North America (with 44% from Canada). Refer to Figure 2 and Figure 3 below:

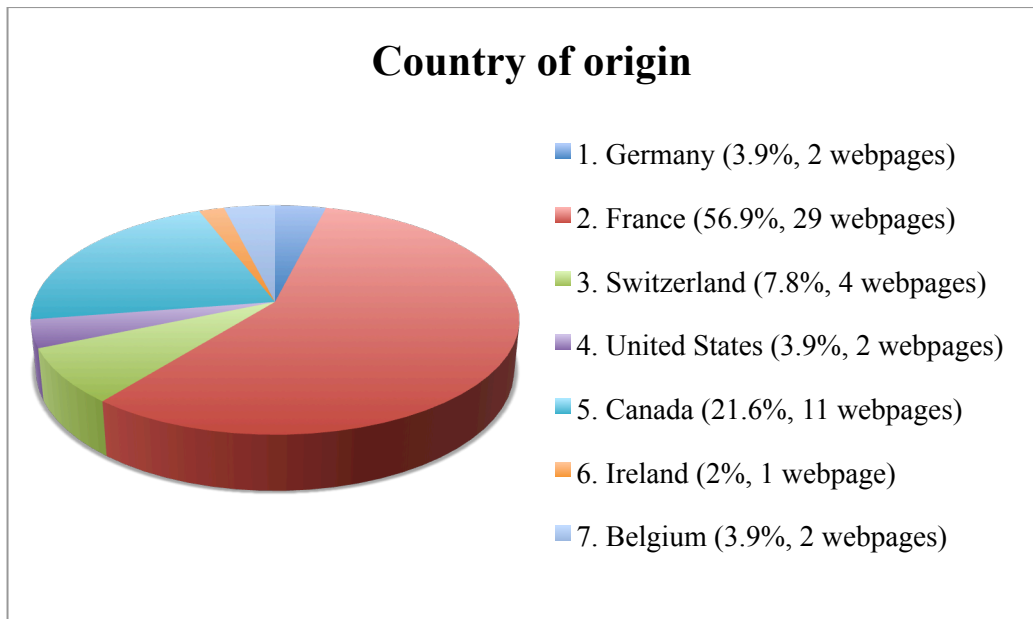


Figure 2. Distribution of the webpages by country of origin

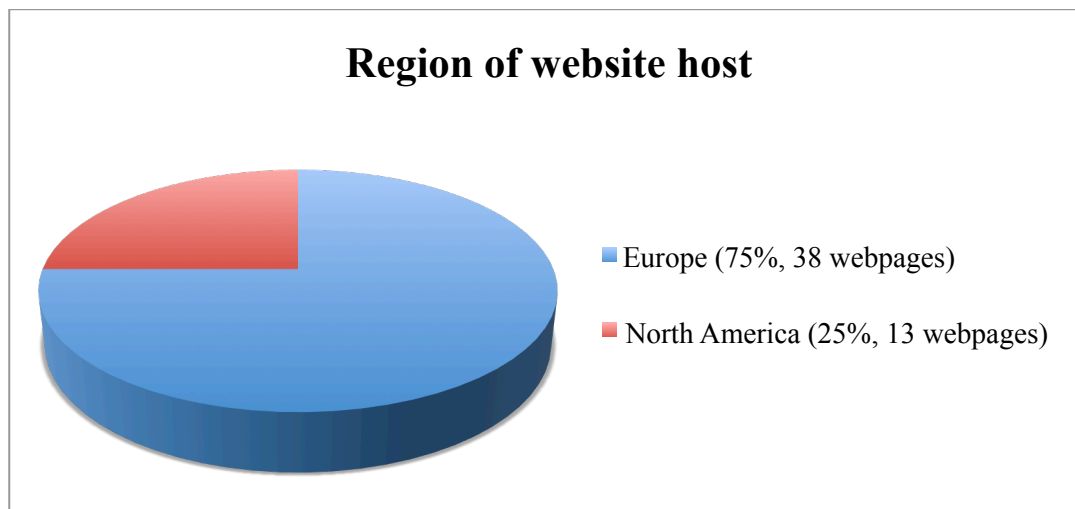


Figure 3. Distribution of the webpages by region of origin

3.3 Type of organisation and HON results

Additionally, a Pearson Chi Square test was performed to evaluate the distribution of webpages in terms of type of organisation (non-profit, commercial and governmental) and HON certification. The majority of the webpages (61%) did not have HON

certification. However, the webpages were equally distributed by type of organisation: $\chi^2(2, 51) = 4.35, p = .13$. Of the 51 webpages, 20 were judged as non-profit, 21 were evaluated as commercial and 10 were linked with governmental institutions, as shown in Figure 4 below:

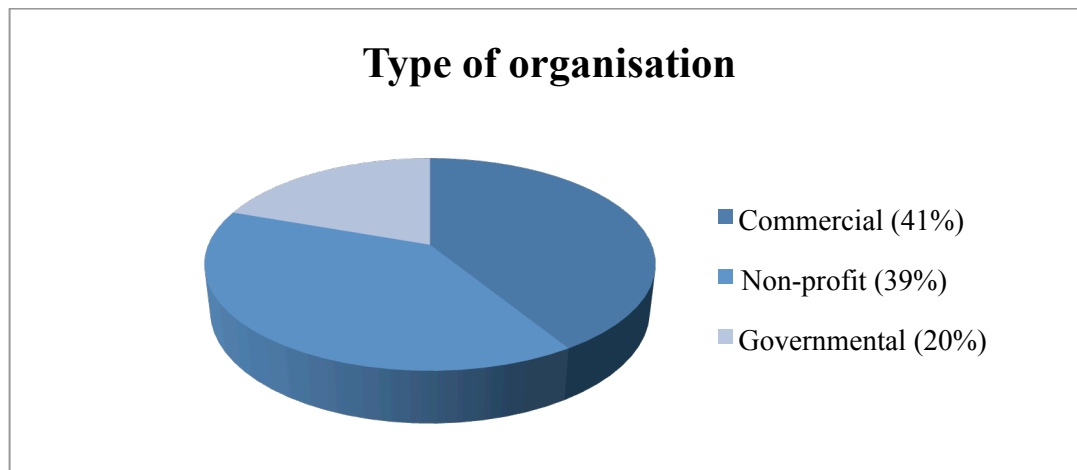


Figure 4. Distribution of the webpages by type of organisation

However, the Chi Square test revealed there was a significant unequal distribution of HON code certification across the type of organisation: $\chi^2(2, 51) = 8.05, p = .02$. The following steps were to analyse the mean DISCERN score across the identified webpages and examine whether there were significant differences in DISCERN scores for webpages based on their type of organisation, region of origin, and presence or absence of HON certification.

3.4 DISCERN ANOVA results

The reliability of the DISCERN ratings obtained from the two native French speakers was assessed using Cronbach's alpha and intra-class correlation coefficient

(ICC), as mentioned earlier in Chapter 2. The reliability between the two raters was excellent, giving credibility to the use of rater one's scores in the ANOVA. The distribution of all assessed webpages based on their obtained DISCERN rating scores can be observed in Figure 5.

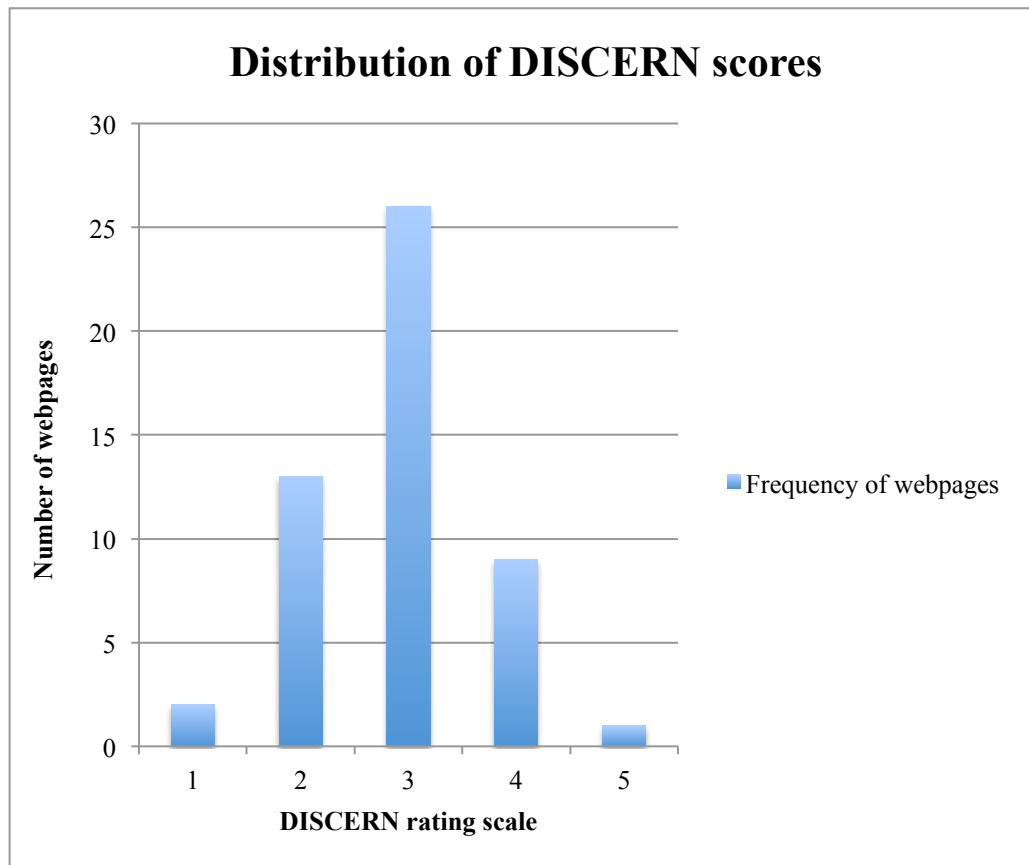


Figure 5. Frequency of the webpages by DISCERN rating scores

The total mean of the DISCERN scores for all 51 webpages was 3.32 (SD = 0.76), ranging from a score of 1.50 as the lowest to 5.00 as the maximum. Only one webpage earned a DISCERN score of 5.00, and two webpages received a low DISCERN score of 1.50. The majority, that is 26 webpages, obtained a DISCERN score between 3.00 and 3.90. In addition, a review of each DISCERN criterion adapted from

Charnock et al. (1999) with the means and standard deviations obtained for all webpages is provided in Table 3 below.

Table 3. DISCERN criteria rated by means and standard deviations of all webpages

Item	Criterion	Mean (SD)
1	Are the webpage's aims towards treatment of hearing loss clear?	2.72 (0.83)
2	Are the webpage's aims achieved?	3.24 (0.40)
3	Is the information provided throughout the webpage relevant to hearing loss treatments?	3.48 (0.60)
4	Does the webpage clearly state the sources where the information regarding hearing loss treatments were retrieved from (other than the author or producer)?	1.77 (1.00)
5	Does the webpage clearly state when the information regarding hearing loss treatments was produced?	2.79 (1.21)
6	Is the information regarding hearing loss treatments balanced and unbiased?	3.40 (0.80)
7	Are there any additional sources of information and support provided to help individuals with a hearing disability?	2.37 (1.31)
8	Are there any areas of uncertainty about hearing loss treatments reported in the webpage?	2.20 (1.14)
9	Does the webpage provide a description of how each treatment for hearing loss works?	3.38 (1.05)
10	Are the benefits of each treatment for hearing loss provided throughout the webpage?	3.07 (1.13)
11	Are the risks of each treatment for hearing loss provided throughout the webpage?	2.01 (1.24)

12	Does the webpage provide information about what would happen if no treatment for hearing loss were chosen?	2.05 (1.11)
13	Does the webpage describe how an individual's quality of life would change after treatment choices for hearing loss?	2.29 (0.99)
14	Is the possibility for more than one treatment choice for hearing loss clearly stated within the webpage?	3.66 (1.13)
15	Is shared decision-making towards hearing loss treatment supported within the webpage?	2.68 (1.16)
16	From all the scores obtained, rate the overall quality of the webpage regarding hearing loss treatment choices.	3.32 (0.76)

It was hypothesised that there would be no significant differences in DISCERN rating scores based on the different type of organisation (non-profit, commercial and governmental). To test the null hypothesis, a one-way univariate ANOVA was used and revealed no significant difference: $F(2, 45) = 1.22, p = .30$. This demonstrates there was no substantial main effect of any type of organisation in the webpages' quality. Moreover, post hoc testing using Least Significant Difference (LSD) test correction disclosed that the mean DISCERN scores was not significantly different based on the type of organisation. In addition, an evaluation of the boxplot revealed no outliers. The bar graph below, shows the mean DISCERN scores of the identified webpages across the three different types of organisation:

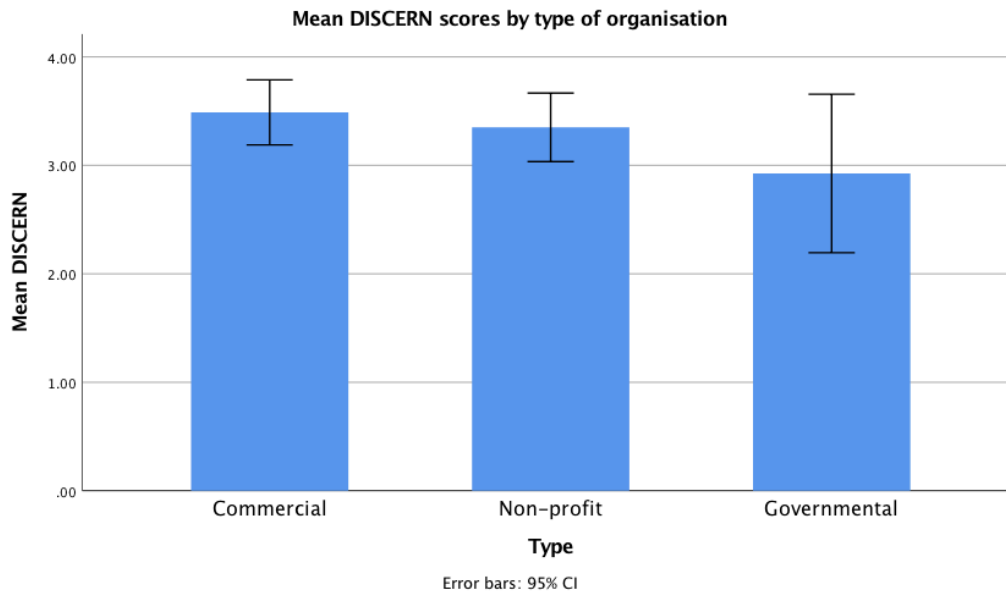


Figure 6. Mean DISCERN scores of the webpages from different type of organisation

Secondly, it was hypothesised that there would be no significant difference in DISCERN rating scores for webpages with and without HON certification. A one-way univariate ANOVA was used to investigate this hypothesis. There was no significant difference in DISCERN scores based on HON certification: $F(1,45) = .55, p = .46$. The DISCERN mean scores based on HON certifications are shown below in Figure 7.

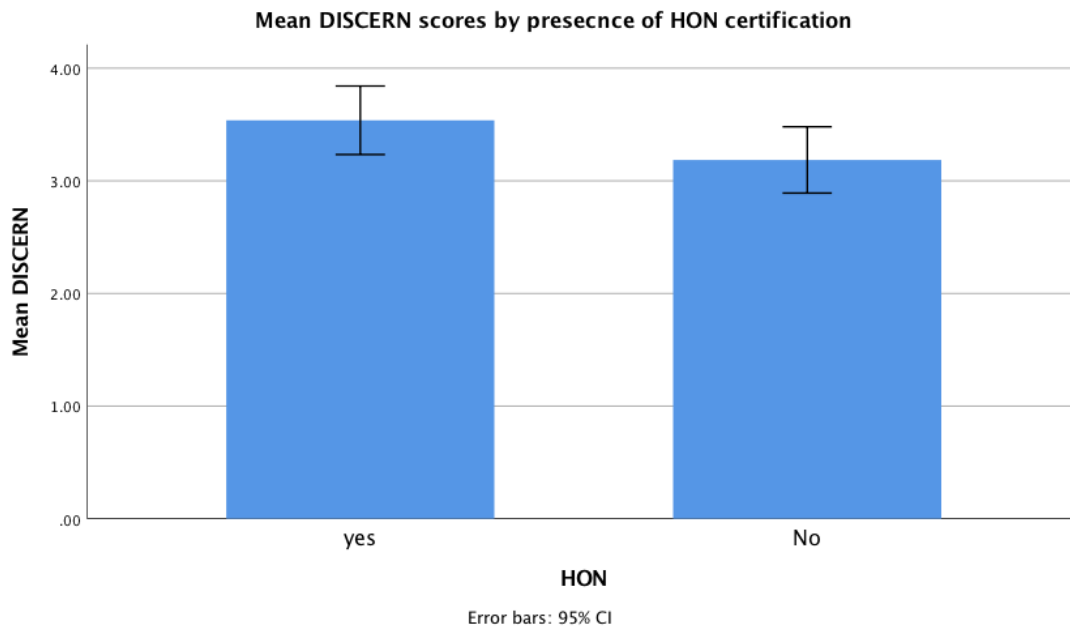


Figure 7. Mean DISCERN scores of the webpages, with and without HON certification

Thirdly, it was hypothesised that there would be no significant difference in DISCERN rating scores of the webpages based on region of website host (Europe and North America). A one-way univariate (ANOVA) was used to investigate this hypothesis and was not statistically significant, $F(1, 49) < .001, p = .98$, indicating no significant difference in the DISCERN scores based on whether the webpages originated from Europe or North America. In addition, an evaluation of skewness and kurtosis statistics revealed that the assumption of normality was supported. The bar graph below shows the mean DISCERN scores of the identified webpages by their region of origin of website hosts (Figure 8):

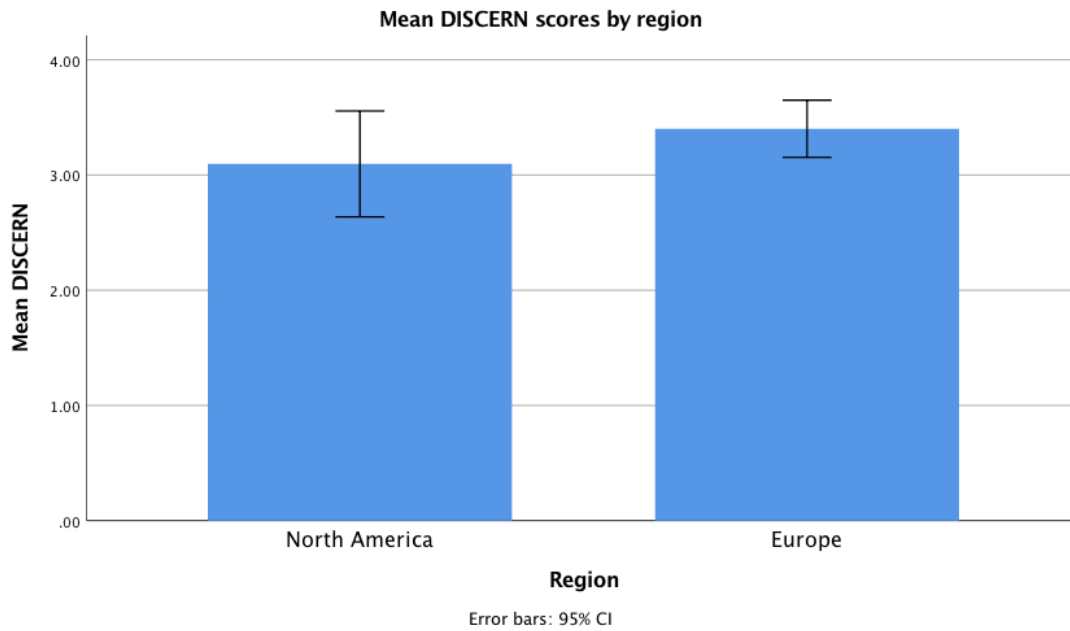


Figure 8. Mean DISCERN scores of the webpages by region of origin

3.5 Readability results

The mean readability score for the 51 quasi-randomly selected webpages was 40.86 (ranging from 11.8 to 68.80) and with a standard deviation of 10.94. The webpages were analysed using the French version of the FRE readability formula. Overall, the webpages reported high readability levels, well exceeding the 5th- to 6th-grade recommended level by health literacy experts. Such results indicate that hearing-related websites in the French language are difficult to read and understand for the average French reader. According to the Flesch classification, a readability score of 40.86 falls within the post-school RGL, corresponding to the *difficult* category and indicating the need for at least thirteen years of formal education to adequately understand the material. The correlation between the RGL and readability scores was addressed in Chapter 2. Out of the 51 webpages, none fell within the recommended reading levels (i.e., below the 6th grade level). Only two webpages were within the 7th-

to 8th-RGL and eight webpages fell into the High school category level. Refer to Figure 9 below:

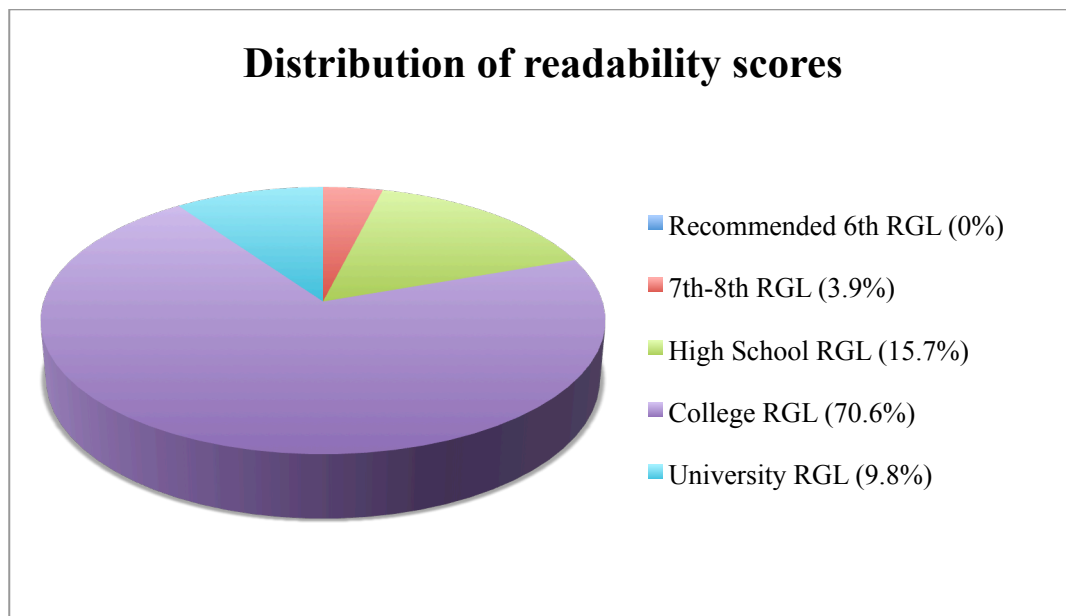


Figure 9. Frequency of the webpages by reading grade level

A univariate ANOVA revealed there was no significant difference in the mean readability scores between webpages based on their region of origin: $F(1,42) = 3.22, p = .08$. Figure 10 provides a bar graph of the mean readability scores of the webpages by region of origin.

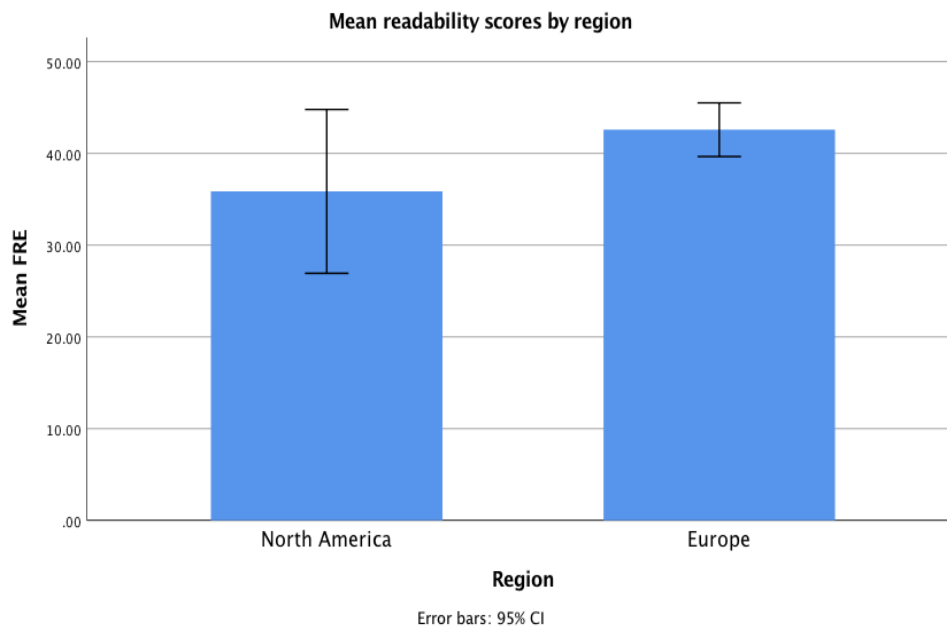


Figure 10. Mean readability scores of the webpages by region of origin

A univariate ANOVA revealed there was no significant difference in the mean readability scores between webpages based on the type of hosting organisation: $F(2,42) = 1.42, p = .25$. Figure 11 below shows a bar graph of the mean readability scores of websites across the three different types of organisation.

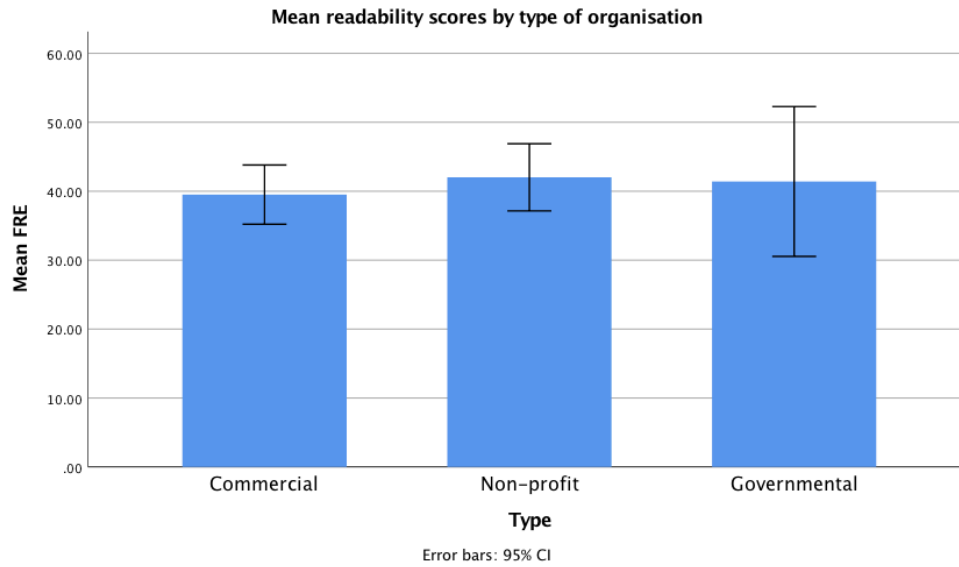


Figure 11. Mean readability scores of the webpages from different type of organisation

A univariate ANOVA revealed there was no significant difference in the mean readability scores between webpages based on HON certification: $F(1,42) = 0.23$, $p = .88$. Figure 12 below shows a bar graph of the mean readability scores of websites with and without HON certification.

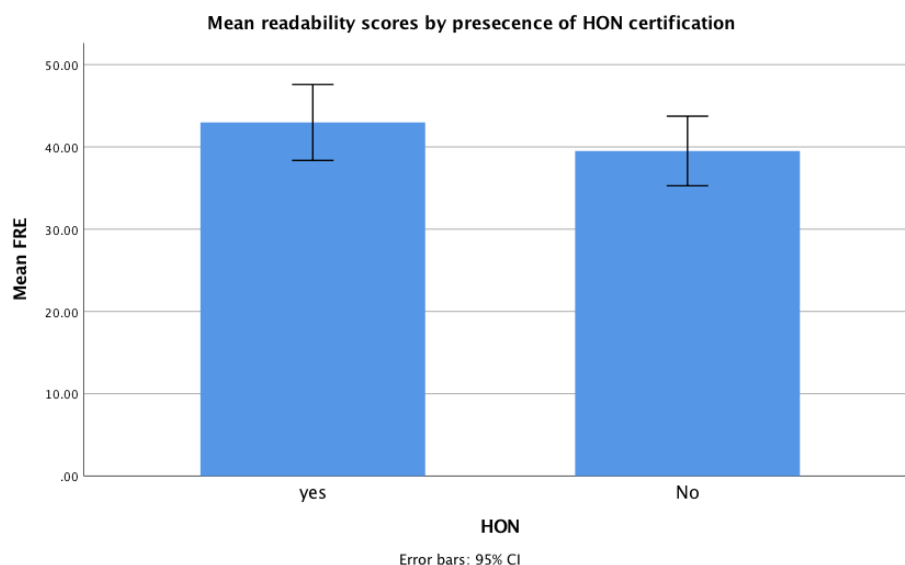


Figure 12. Mean readability scores of the webpages, with and without HON certification

Finally, it was hypothesised that there would be no significant correlation between the DISCERN scores and readability scores of all webpages. A Pearson correlation was used to investigate this hypothesis. It was found there was a positive non-significant relationship between DISCERN and readability scores: $r(49) = .17$, $p = .24$.

3.6 Results summary

The majority of the webpages exhibited moderate quality information as determined by the DISCERN rating scores. Similarly, the readability level of all webpages was higher than the recommended level, indicating at least thirteen years of education for the consumers to efficiently read and comprehend the hearing-related information. Results show that no significant differences were found for DISCERN scores for webpages based on the region of website host, type of organisation, and on the presence or absence

of HON certification. Additionally, there was a positive non-significant relationship between DISCERN and readability scores.

Chapter Four: Discussion

4.1 Overview

The aim of the current study was to primarily evaluate the quality of online hearing-related health information in the French language. The quality of the online retrieved information was assessed using the DISCERN rating scores, and hypotheses were formulated with reference to their region of website host (Europe and North America), type of organisation (non-profit, commercial and governmental) and presence or absence of HON code certification.

A total of 51 webpages previously identified by Serban (2018) were assessed for the purpose of this study. Overall, most of the identified webpages originated from Europe (75%) and North America (25%). Moreover, the majority of the webpages were of non-profit origin and commercial background. Commercial type of websites tended to focus on diverse hearing aid manufacturers, audiology clinics and various medical surgery practices. Only ten webpages were of governmental origin and they tended to focus on specific topics regarding hearing loss, such as communication strategies and financial assistance for hearing aids.

The following sections examined the identified webpages in terms of their quality and readability rating scores. Additionally, features of the websites were assessed, and recommendations were made on how the websites' configurations could be improved. Finally, the clinical implications and limitations of the study were reviewed.

4.2 DISCERN scores

The DISCERN scores of the 51 assessed webpages varied from 1.50 to 5.00 (5.00 being the maximum). The majority of the webpage scores ranged between 3.00 and 3.90, two webpages obtained a low score of 1.50 and only five webpages scored between 4.50 and 5.00. The mean DISCERN score of all webpages was 3.32, exhibiting moderate quality content. According to Charnock and Shepperd (1999), a score of 1 to 2 denotes a low quality rating and a score of 3 indicates a moderate quality rating. Additionally, in answering the proposed study hypotheses, no significant differences in DISCERN scores were found as a function of the regions of website host, types of organisation and whether they had HON certification. Moreover, there was no significant correlation between the readability scores and DISCERN scores.

The DISCERN scores in this study were higher overall than the DISCERN scores obtained in other studies such as Laplante-Lévesque et al. (2012). Moreover, in contrast to Laplante-Lévesque and colleagues, this study found that websites from a non-profit organisation did not show significantly higher DISCERN scores as compared to websites from a governmental and commercial origin. The present study aligns with Potter (2015) who has assessed the quality of online information specific to hearing in New Zealand and similarly found no significant differences in DISCERN scores based on the websites' types of organisation (non-profit, commercial and governmental). Similarly, past studies have shown that the content quality of a significant amount of online health materials lack accuracy, completeness and can potentially be misleading (Beaunoyer et al., 2017; Charnock et al., 2005; Eysenbach, et al., 2002; Griffin et al., 2003); this also includes online healthcare materials published in the French language (Givron et al., 2004; Richard et al., 2007). For instance, Givron et al. (2004) reported that the vast majority of online information on urinary incontinence from French-

speaking websites was of poor quality, and only four websites received high recommendations. Such diversity in findings attests to the high variability of DISCERN scores.

Another way to examine the quality and accuracy of online information is with the use of HON code certification. As discussed earlier, this set of guidelines has been designed to help website creators assure their Internet consumers that their online health materials are reliable and trustworthy (Shedolsky-Shoemaker et al., 2008). Despite the unequal distribution of HON code throughout the hearing-related French webpages, the present study has found no significant differences in DISCERN scores based on the presence or absence of HON certification. Nevertheless, as reported by Team HON (2018), I believe that a display of the HON logo on websites remains a recommended tool to help consumers identify approved material and reassures readers of the accuracy of the published health materials. There are other factors that can influence the quality of healthcare information on the Internet.

Assessing in greater depth the different items or criteria of the DISCERN questionnaire can help identify the elements influencing the quality of information. Items 3, 9, 10 and 14 obtained a highest DISCERN mean scores (i.e., a score of 4.00 or above, refer to Table 3 in Chapter 3). They indicated that French websites provide relevant and satisfactory hearing-related information of various treatment options (e.g., hearing devices, ALDs and surgery), while making sure that the benefits and a description of each treatment are well pointed out. Conversely, items 4, 5, 7 and 11 obtained the lowest DISCERN mean scores (i.e., a score of 2.50 and below). They highlighted the trend that French hearing-related websites not only lack satisfactory referencing, but also lack additional sources of support and information for consumers with a hearing disability. Additionally, the materials provided were not always delivered

in a balanced and unbiased way. The overall lack of high quality hearing-related materials presented and available to French readers is alarming as it can potentially lead individuals with hearing impairments to trust deceptive information, which in turn can impact their health conditions.

The quality of information on websites could be improved by providing adequate referencing and by clearly stating where the information was acquired, offering up-to-date links to other websites as additional sources of material and suggesting other contact information so the reader can find extra support. Furthermore, the information can be presented in a less biased manner by acknowledging the treatment's limitation and discussing multiple points of view that describe the risks and benefits of each treatment option that is relevant to the reader. Finally, encouraging shared decision-making with their clinician can help the patients to feel more empowered and in control of their health conditions. Active involvements in health management have been shown to lead to greater health outcomes (Fox & Rainie, 2002; Shuyler & Knight, 2003).

4.3 Readability scores

Overall, the assessed webpages were written at a high readability level, with a mean readability score of 40.86, exceeding by far the 5th- to 6th-grade level recommended by health literacy specialists such as Doak et al. (1996). Based on the Flesch Index classification developed for French texts, a readability score of 40.86 falls within the post-school RGL and corresponds to the *difficult* category (refer to Table 2 in Chapter 2). This means that French-speaking individuals require between 12 and 14 years of formal education to adequately read and comprehend hearing-related materials available on the Internet. The present findings are aligned with previous researchers who have also reported that the readability levels of online health information are

significantly higher than the recommended 5th- to 6th-grade level (Barak & Sadovsky, 2008; Greywoode, Bluman, Spiegel, & Boon, 2009; Walsh & Volsko, 2008), including online hearing-related information as evaluated by Atcherson et al. (2014), Laplante-Lévesque et al. (2012), and Laplante-Lévesque and Thorén (2015). For example, a study conducted by Pothier (2005) evaluating the readability level of websites on otitis media with effusion, obtained a readability score exceeding by far the recommended level.

As established above, the average French speaker is required to have a high literacy level in order to fully comprehend the hearing-related information presented on the Internet and judge whether it is reliable and accurate. Such findings are concerning, as the average reader with limited medical knowledge may lack the ability to effectively read and evaluate complex written health information (Atcherson et al., 2014). The use of jargon (complex vocabulary), polysyllabic words (three syllables or more), passive voice and long sentence structure in a text can reduce the ease of understanding (Laplante-Lévesque et al., 2012) and should be avoided. In order to assess the difficulty of online material and maintain it at a satisfactory readability level, website developers and clinicians can perform simple readability analyses available on the Internet such as with the Flesch Reading Ease formula. Other readability formulas such as Flesch-Kincaid, the SMOG are commonly used in the English language; however, other adapted formulas, such as the FRE version developed for the French language, are accessible for evaluating other languages and can be used to ensure that the readability of a text is within the recommended 5th- to 6th-RGL.

Based on the present findings, no significant differences in readability were found for the variable tested: the region of website host, type of organisation and HON certification. In addition, the findings indicated that quality and readability of information are distinct matters: no significant relationship was found between the

DISCERN scores and the RGL of the 51 assessed webpages. Adequate readability can be achieved while maintaining high quality of the information, and vice versa. It is essential that hearing-related information is written and presented in a manner that is easy to read and understand, in order for HI patients to make more appropriate treatment choices and better manage their own health. Furthermore, to facilitate interaction and maintain a trust-based relationship with the patients, clinicians must be mindful of the reading grade level and quality of the written healthcare materials they provide to their patients (e.g., clinic pamphlets, online materials), and make sure they are directing patients towards clear, concise and high quality online sources of information written at the recommended RGL.

4.4 Clinical implications

The Internet has become a popular and common source of information for people to access health information (Baker et al., 2003; Fox, 2006; Fox, 2011; Laplante-Lévesque et al., 2010), including for individuals impacted with a hearing disability (Peddie & Kelly-Campbell, 2017). With the recent significant growth in prevalence of Internet use in Africa (Internet World Stats, 2018), including middle and low socioeconomic Francophone countries within Africa, consumers with a HL are gaining greater access to information in the French language related to hearing. Thus, it is essential that health content provided on the Internet is of high quality, as accurate as possible and easy to understand for the general public. The findings of the present study indicated that French speakers around the world do not currently have access on the Internet to content of satisfactory quality, nor easy-to-read materials about hearing impairment.

According to Laplante-Lévesque and colleagues (2012), an individual's ability to read and understand clearly written information will be echoed in their aptitude to use and comprehend online health information. Access to inadequate quality of online health materials can lead patients to misinterpret information (Beaunoyer et al., 2017), and in turn can negatively influence the health behaviour of the readers (Fox & Jones, 2009). Moreover, individuals with poor health literacy display poorer health knowledge and are more likely to present lower health outcomes (Berkman et al., 2011; DeWalt et al., 2004). Misleading information can lead to a patient's hearing disability worsening, causing potential harm and a decrease in wellbeing over time (Beaunoyer et al., 2017; Griffin et al., 2003), and hence it is crucial that patients have access to reliable high quality and evidence-based materials.

The general public has developed a tendency to self-diagnose using the Internet (Fox & Rainie, 2002), as online search is frequently done prior to seeking professional assistance (Laplante-Lévesque et al., 2012). According to Diaz et al. (2002), the majority of patients who seek medical information on the Internet do not share this information with their doctors during consultations, through fear of negatively impacting their relationship with their clinician. However, studies have shown that a respectful collaboration between clinicians and patients in analysing health information, including acquired online materials, led to greater patient fulfilment (McMullan, 2006), offered an opportunity for patients to become more informed and contributed towards shared decision-making (Cline & Haynes, 2001; Fox, 2006). Furthermore, an approach that is focused on the patient-centred care (or PCC) can encourage the patients to seek support, be more informed about their hearing conditions and adopt the recommended hearing devices (Kelley et al., 2015). It is the clinicians' responsibility to work in collaboration

with their patients and guide them towards satisfactory quality materials that are also suitable for their literacy skills.

Online search for health information provide independent learning, contribute towards self-empowerment (Sommerhalder, Abraham, Zufferey, Barth, & Abel, 2009), and increase the patient's involvement in their personal health management (Fox & Rainie, 2002; Lorig et al., 2002; Shuyler & Knight, 2003). Grenness et al. (2015) reported that patients who purposely seek information show greater motivation to undertake treatments and in turn achieve greater rehabilitation outcomes. In order for individuals to make informed health treatment choices and improve their health outcomes, information must be of high quality and written at an appropriate reading level (Shepperd et al., 1999). Thus, whether this refers to medical providers, audiological businesses, hearing-aid manufacturers or governmental organisations, it is crucial that all ensure that the quality and readability level of the provided health materials are optimal. As discussed earlier, there are various easy-access readability formulas that can be used by website developers before publishing any materials. Moreover, the criteria mentioned in this study can assist the clinicians in evaluating the quality of online materials, before directing it to the patients.

4.5 Limitations and future investigations

To examine the quality and readability of online information specific to hearing, a few methods were used. The DISCERN tool and HON code certification were used to assess the quality of online materials, and the FRE formula was used to evaluate its readability.

Readability formulas do not offer any indication of the comprehension of a written text. Thus, a focus on the individual's comprehension of healthcare materials should be further investigated. In addition, other factors such as information layout, experience, culture and motivation can impact the suitability of the information, that is, the level to which a specific population can understand the healthcare materials (Nasser, Mullan, & Bajorek, 2012). For instance, according to Robins, Holmes and Stansbury (2010), visual designs tend to influence the reader's discernment of a written text and should be considered. The most common tool used to examine such factors is the Suitability Assessment of Materials or SAM (Doak et al., 1996). Further research can be done to assess the suitability of written health materials.

Regarding to the quality variable, the DISCERN questionnaire was selected due to its frequent use in assessing online health information, including hearing impairment, and for its psychometric properties. Nevertheless, as argued by Laplante-Lévesque and colleagues (2012), the DISCERN tool helps to analyse the completeness of the information but fails to provide scientific evidence supporting the truthfulness of the information presented. Finally, to avoid poor inter-rater reliability of DISCERN scores between different studies and avoid subjective interpretation of the DISCERN questions, the use of a standardised version of the DISCERN tool might reduce such a gap and help maintain consistency in scoring. An example of a standardised version of DISCERN, which has been used in this study, is available in the Appendix.

4.6 Conclusion

This study primarily investigated the quality of online health information available in the French language specific to hearing. The quality of each website was assessed

using the DISCERN questionnaire. The DISCERN rating scores obtained from 51 webpages were then examined in terms of their region of website host (Europe and North America), type of organisation (non-profit, commercial and governmental) and whether they had HON code certification. Overall, the findings showed that the quality and readability of the assessed websites were far from optimal. The current results revealed that hearing-related information available on the Internet to French readers with a hearing disability are hard to read and of moderate quality. Such findings are concerning, as misinterpreting health materials can have important consequences on one's health. However, there are procedures that can assist website designers and help clinicians in guiding patients towards clear, understandable and high quality information, which will benefit individuals in making informed health-treatment choices and improve their wellbeing.

Appendix

Adapted version of Charnock et al. (1999) DISCERN questionnaire, created by Master of Audiology student Alexander Lashuk and reviewed by me.

Question 1: Are the webpage's aims towards treatment of hearing loss clear?

Aim must be at the beginning of the article

- 1 = Aim not present at all
- 2 = The title of publication gives us a rough indication of the aim
- 3 = Aim describes only one of the following: what it is about, what it is meant to cover, target audience.
- 4 = Aim describes two of the following: what it is about, what it is meant to cover, target audience.
- 5 = Aim provides all three: what it is about, what it is meant to cover, target audience.

Question 2: Are the webpage's aims achieved?

- n/a = Question 1 was scored as 1
- Rate the question from 1-5 in accordance of how well the aims from question 1 were covered.

Question 3: Is the information provided throughout the webpage relevant to hearing loss treatments?

Rate this question from the perspective of the patient. Question is not affected by readability.

- Publication does not use offensive language e.g. not patronizing or stigmatizing (1 point)
- Publication does not leave the reader with any unanswered questions (2 points) *or* leaves only a few unanswered questions (1 point)
- The recommendations are realistic (1 point) and appropriate (1 point) for majority of the general public

Question 4: Does the webpage clearly state the sources where the information regarding hearing loss treatments were retrieved from (other than the author or producer)?

- 1 = No sources of evidence provided at all
- 2 = Publication mentions an institution of where the evidence was obtained, e.g. “researchers at the University of Canterbury”, or an incomplete reference to a person “according to Dr. Smith”
- 3 = Publication provides a bibliography, but no in text citation.
- 4 = Publication provides a bibliography and some in text citation
- 5 = Publication provides a bibliography and all scientific facts are followed by an in text citation.

Question 5: Does the webpage clearly state when the information regarding hearing loss treatments was produced?

- 1 = No dates have been provided
- 2 = Only copyright information provided
- 3 = Only date of publication provided
- 4 = Date of publication and revision date provided
- 5 = Date of publication/revision and dates of main sources of information provided.

Question 6: Is the information regarding hearing loss treatments balanced and unbiased?

- Publication does not focus on advantages/disadvantages of a single treatment unless that is the aim of the publication and the author has acknowledged that other treatment choices exist (1 point).
- Publication does not focus on evidence from specific cases, but rather uses evidence that can be applied to the general public, unless that is the aim of the publication (1 point)
- Publication does not provide information in an emotive or alarmist way, no shock tactics used (0.5 points).
- Information is provided from an objective point of view, rather than a personal view (0.5 points)
- A range of sources of evidence were used to compile the publication (1 point).
- The publication is independently reviewed and approved by an expert, professional organization or consumer group (1 point)

Question 7: Are there any additional sources of information and support provided to help individuals with a hearing disability?

- 1 = No information provided
- 2 = Further information from the same organization provided
- 3 = Only bibliography provided
- 4 = Further readings provided, but without enough detail to retrieve information easily
- 5 = Further readings provided with enough details to retrieve information easily.

Question 8: Are there any areas of uncertainty about hearing loss treatments reported in the webpage?

- 5 = Publication describes a *clear* uncertainty about the treatment options, either for each treatment choice or in a general sense.
- 2-4 = Uncertainty provided but information is not clear or incomplete
- 1 = No uncertainties about treatment options are provided.

Question 9: Does the webpage provide a description of how each treatment for hearing loss works?

- 5 = Publication describes how each described treatment works in a clear and complete way.
- 4 = Publication describes how each treatment works, but information is not always clear or detailed enough.

- 3 = Publication describes how only one of the treatments works, but in a clear and complete way
- 2 = Publication describes how only one of the treatments works, but information is not clear or detailed enough.
- 1 = Publication does not describe how any of the treatments work.

Question 10: Are the benefits of each treatment for hearing loss provided throughout the webpage?

- 5 = Publication describes the benefits of each treatment in a clear and complete way.
- 4 = Publication describes the benefits of each treatment, but information is not always clear or detailed enough.
- 3 = Publication describes benefits of only one treatment, but in a clear and complete way
- 2 = Publication describes benefits of only one treatment, but information is not clear or detailed enough.
- 1 = Publication does not describe any benefits for any of the treatment options.

Question 11: Are the risks of each treatment for hearing loss provided throughout the webpage?

- 5 = Publication describes the risks of each treatment in a clear and complete way.
- 4 = Publication describes the risks of each treatment, but information is not always clear or detailed enough.

- 3 = Publication describes risks of only one treatment, but in a clear and complete way
- 2 = Publication describes risks of only one treatment, but information is not clear or detailed enough.
- 1 = Publication does not describe any risks for any of the treatment options.

Question 12: Does the webpage provide information about what would happen if no treatment for hearing loss were chosen?

No treatment is not the same thing as the description of the pathology.

- 5 = Publication provides a clear description of a risk *or* a benefit associated with *any* no treatment option.
- 2-4 = Publication provides a description of a risk *or* a benefit associated with *any* no treatment option, but information is not unclear or incomplete.
- 1 = Publication does not include any reference to the risks or benefits of no treatment options.

Question 13: Does the webpage describe how an individual's quality of life would change after treatment choices for hearing loss?

- 5 = Publication includes a clear reference to overall quality of life in relation to any of the treatment choices mentioned, including no treatment if question 12 was ranked higher than 1. To get a 5, the article must mention how the treatment affects both day-to-day activities and the patient's relationships with others.

- 4 = Publication includes a clear reference to overall quality of life in relation to any of the treatment choices mentioned, and has to mention how the treatment affects either day-to-day activities *or* the patient's relationships with others
- 3 = Publication includes a reference to overall quality of life in relation to any of the treatment choices, but information is not clear or complete enough.
- 2 = Publication provides any reference to how the condition can affect the overall quality of life.
- 1 = There is no reference to overall quality of life in relation to treatment choices.

Question 14: Is the possibility for more than one treatment choice for hearing loss clearly stated within the webpage?

- 5 = Publication makes it very clear that there may be more than one possible treatment choice and mentions who is likely to benefit from each treatment choice.
- 4 = Publication makes it very clear that there may be more than one possible treatment choice but does not mention who is likely to benefit from each treatment choice.
- 2-3 = Publication suggests that there may be more than one treatment choice, but the information is not clear or complete enough.
- 1 = Publication does not indicate that there may be more than a single treatment option.

Question 15: Is shared decision-making towards hearing loss treatment supported within the webpage?

- 5 = The publication suggests which things to discuss with both a health professional and family/friends concerning treatment options in a clear way.
- 4 = The publication suggests which things to discuss with either a health professional or family/friends concerning treatment options in a clear way.
- 3 = The publication suggests which things to discuss with either a health professional or family/friends concerning treatment options, but not clearly.
- 2 = Publication mentions some aspect of shared-decision making briefly.
- 1 = Publication does not provide any support for shared-decision making.

Question 16: From all the scores obtained, rate the overall quality of the webpage regarding hearing loss treatment choices.

- Should not be a mean score of the above questions.
- Ratings can be up to the nearest 0.25 of a score.

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